Case Studies - Concrete Overlays

Lessons Learned - Concrete Overlays

Purdue Road School
March 6, 2013

ACPA
INDIANA CHAPTER

Count on Concrete
Indiana

IRMCA
INDIANA READY MIXED
CONCRETE ASSOCIATION

Today's Topic

1. **Overlays**
2. New Full-depth
3. Pervious
4. Roller Compacted
5. Full Depth Patching
6. Partial Depth Patching
7. Diamond Grinding

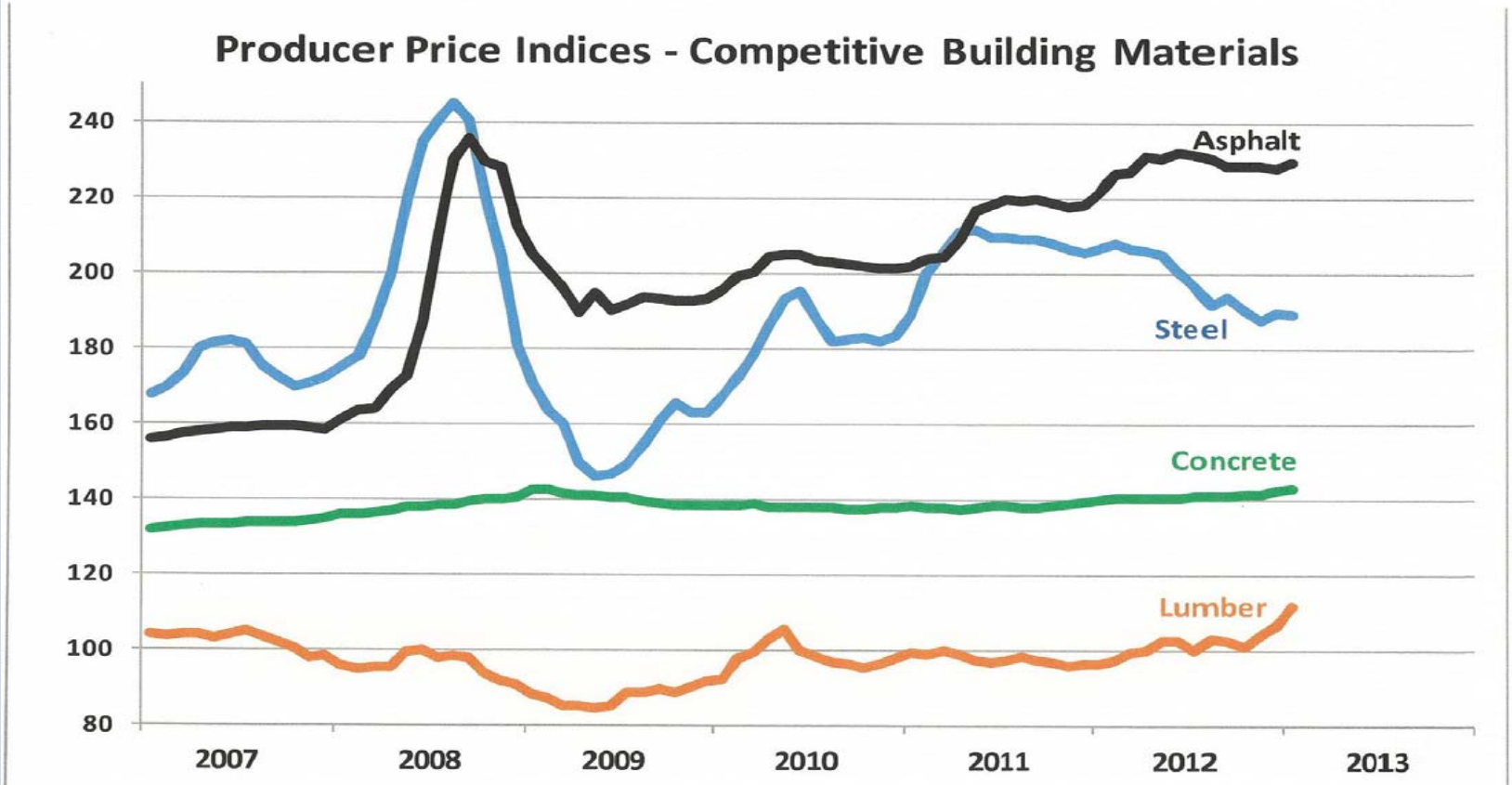
What are we talking about??

- Concrete overlays over old concrete
- Concrete overlays over old asphalt pavements
- Concrete overlays over old composite pavements

What Know or Have Learned

- Cost Competitive
- Long Lasting
- Versatile
- Traditional Construction
- Constructed Rapidly
- Sustainable
- Wide Spread Use Across Country

Competitive



Source: Bureau of Labor Statistics

Traditional Construction

Traditional Construction

Constructs Rapidly

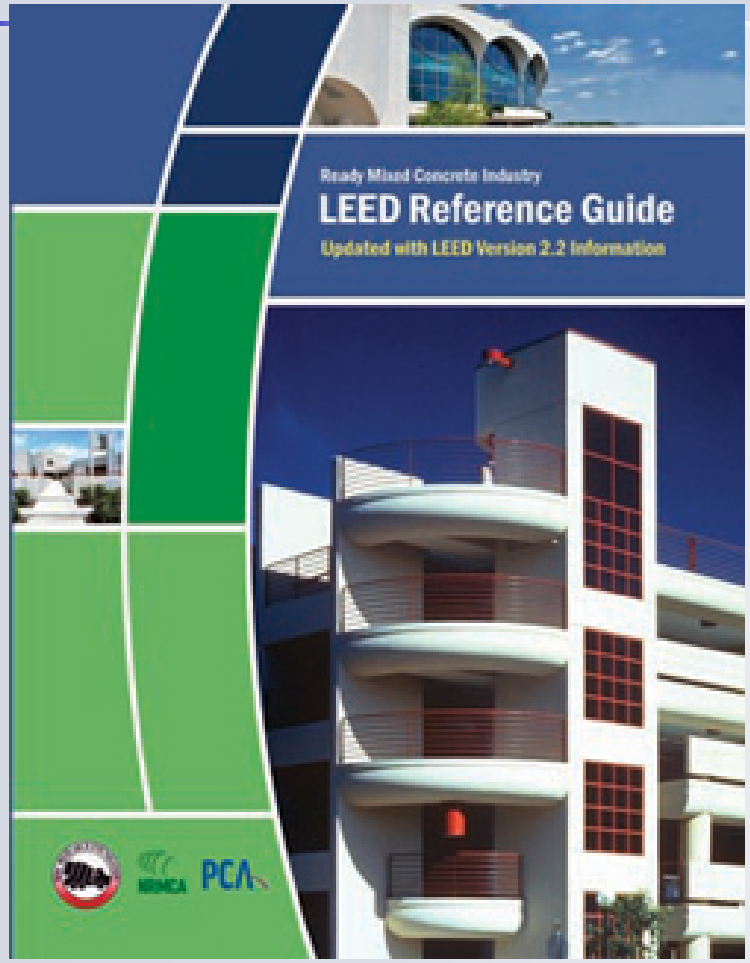
Single pass – full depth

Constructs Rapidly

Bremen Highway
Joseph Co., IN
Bonded Overlay

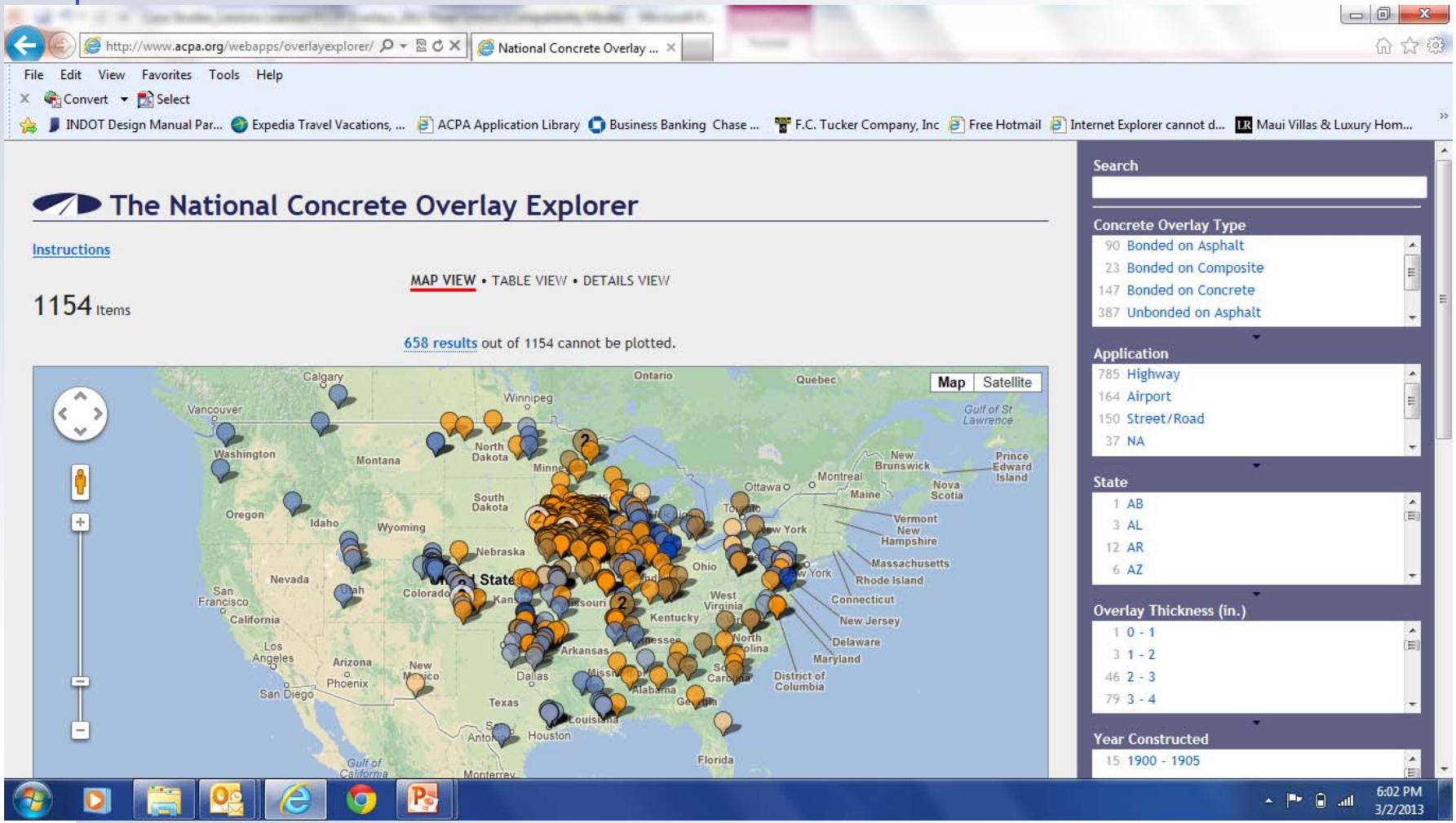
4” PCCP Inlay
24’ wide – 0.9 mi.
Paved in 1 day

Sustainable



- Local Materials
- Recycled materials
- One-pass placement
- Longevity, fewer cycles
- Light reflective
- Mitigates “Heat Island” effect

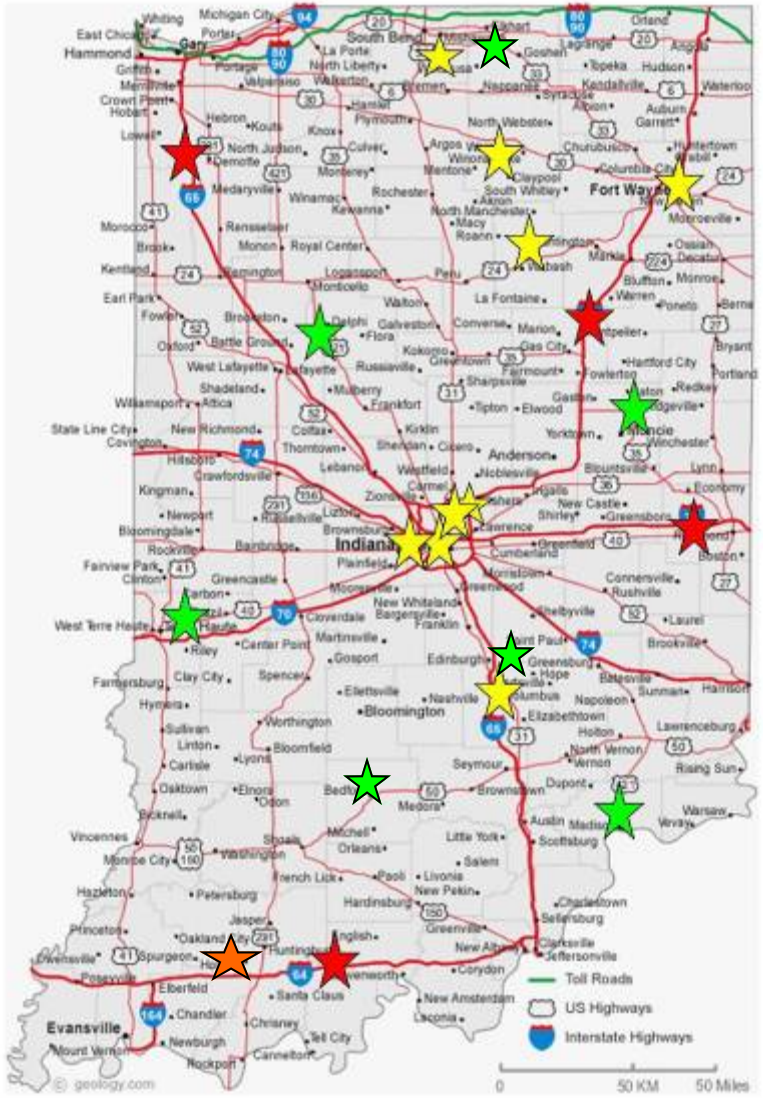
Widely Used Across the Country



How do we know?

Let's look at a few projects

Indiana's Concrete Overlays



Local Streets/Roads

Airports

Interstate Highway

State Highway

Indiana Overlays
Local Roads

- Harding Street – Indianapolis – 6” 1985
- 121st Street – Fishers – 9” 1992
- Indianapolis Bus Lanes – 3.5” 1997
- Allisonville Rd – N. of 96th – 7” 1999
- 56th Street – Brownsburg – 5” 2001
- Market & Columbia – Warsaw – 3.5” 2002
- Rudisill/Broadway Inter. – Fort Wayne – 6” 2006
- Bremen Highway – St. Joseph Co. – 4” 2007

Indiana Overlays
Interstate and State Routes

Interstate and State Routes

I – 69 North of SR 18 – 11”	1986
I – 65 North of SR 114 – 10.5”	1994
1 – 94 West of SR 39 – 13”	1998
I – 70 at US 27 – Richmond – 12”	2000
SR 161 – Dubois Co. – 6”	2010

Indiana Overlays
Airports

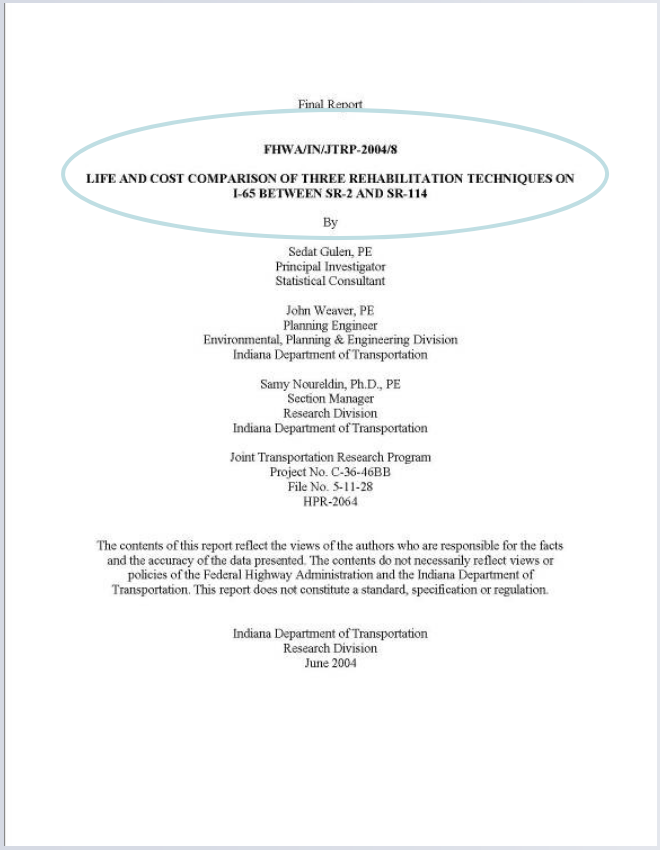
Madison Airport Apron – 3.5”	2000
Grissom AR Fueling Apron – 6”	2007
Delphi Runway – 5.75”	2008
Elkhart Runway – 10”	2009
Jasper Co. Runway – 6”	2009
Columbus Runway – 10”	2010

INDOT Research HPR-2064

Life & Cost Analysis of Three Rehabilitation Techniques on I-65 Between SR 2 & SR 114

I-65 Pavement Rehab Comparison

LIFE AND COST COMPARISON OF THREE REHABILITATION TECHNIQUES ON I-65 BETWEEN SR-2 AND SR-114



Final Report

FHWA/IN/JTRP-2004/8

LIFE AND COST COMPARISON OF THREE REHABILITATION TECHNIQUES ON I-65 BETWEEN SR-2 AND SR-114

By

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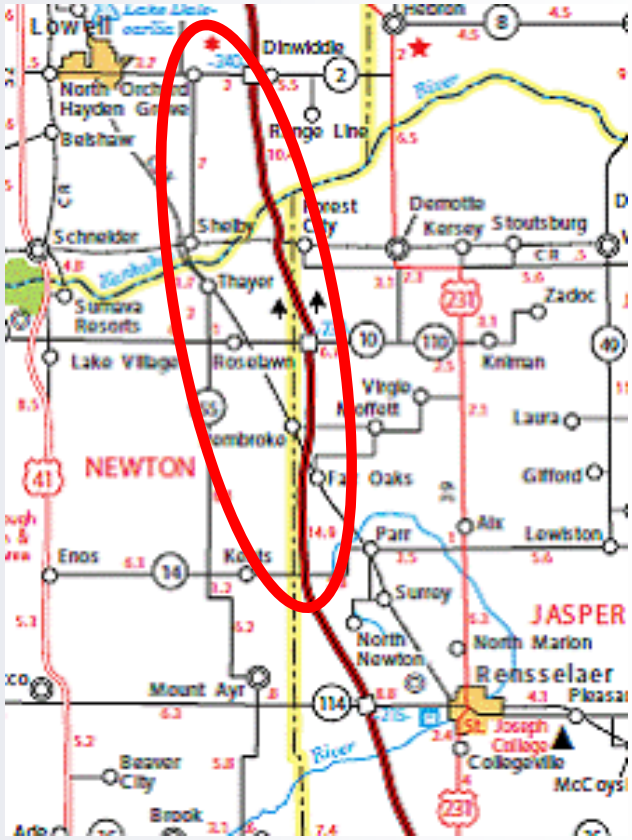
Joint Transportation Research Program
Project No. C-36-46BB
File No. 5-11-28
HPR-2064

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented. The contents do not necessarily reflect views or policies of the Federal Highway Administration and the Indiana Department of Transportation. This report does not constitute a standard, specification or regulation.

Indiana Department of Transportation
Research Division
June 2004



3 Rehabilitation Techniques

- “Crack and Seated”

  Fiber modified HMA overlay on cracked and seated concrete - 8.7 miles

- “Rubblized”

  HMA overlay on the rubblized concrete - 5.7 miles

- “Unbonded Concrete Overlay”

  on 30mm intermediate HMA layer on the existing concrete - 6.2 miles

I-65 Rehab Options

- MP 217.2 – 223.4 – Concrete Overlay
  - Built 1993 - $239,800/center line mile
- MP 223.4 – 229.1 – 13” HMA Overlay over Rubblized old Concrete Pavement
  - Built 1994 - $236,000/center line mile
  - 2000 – route & seal cracks - $17,200/cl mile
  - 2010 – Mill 2” & overlay – $96,800/cl mile
- MP229.1 – 237.8 – 7.5” HMA Overlay over crack & seated old concrete pavement
  - Built 1993 & 1994 - $180,500/ center line mile
  - 2000 – route & seal cracks - $17,200/cl mile
  - 2008 – mill & overlay all HMA - $355,942/cl mile

I-65 Rehabilitation Options

- 7.5” HMA Overlay over crack & seated PCCP
  - Built 1993 & 1994
  - Route & seal cracks
  - Mill all HMA & overlay 2009
  - 30 years service - $18,455/center line mile/year of service

2009 contract to mill 7.5” & overlay

I-65 Rehabilitation Options

- 13” HMA Overlay over Rubblized old PCCP
  - Built 1994
  - Route & seal cracks 2000
  - Mill 2” & 2” HMA overlay July 2010
  - 30 years service - $11,667/center line mile/year of service

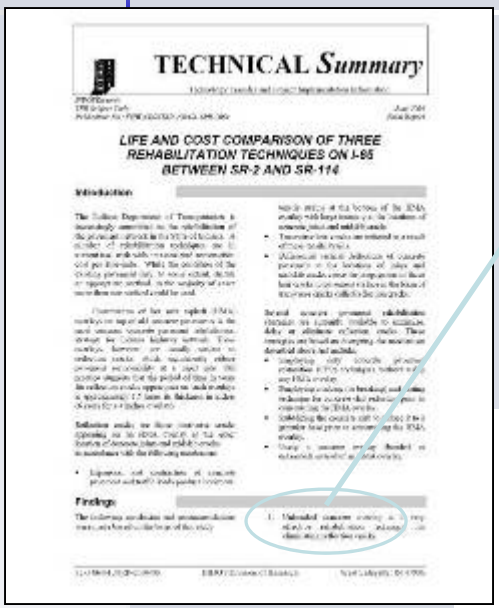
2010 contract to mill 2” & overlay

I-65 Rehabilitation Options

- Concrete Overlay
  - Still “Like New” condition
  - 30 years service - $7993/center line mile/year of service

No Rehab contracts to date – route & seal 2014??

2004 Findings and Implementation


TECHNICAL *Summary*

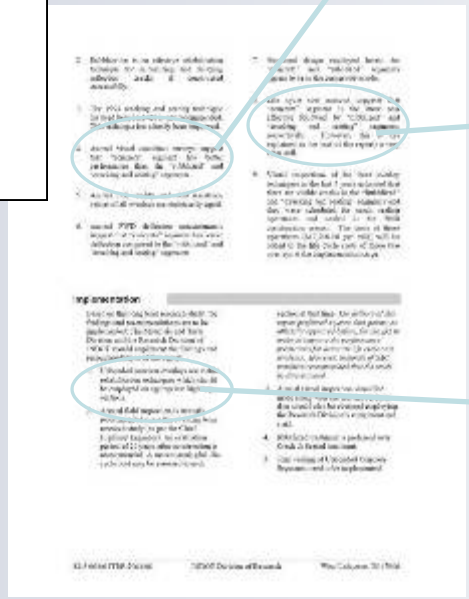
LIFE AND COST COMPARISON OF THREE REHABILITATION TECHNIQUES ON I-95 BETWEEN SR-2 AND SR-114

Introduction

Findings

"Unbonded concrete overlay is a very effective rehabilitation technique for eliminating reflection cracks."

"Annual visual condition surveys suggest that "concrete" segment has better performance than the "rubblized" and "cracking and seating" segments."



"Life cycle cost analysis suggests that "concrete" segment is the most cost effective..."

"Unbonded concrete overlays are viable rehabilitation techniques which should be employed on appropriate highway sections."

Example Projects

Bremen Highway
Joseph Co., IN
Bonded Overlay

4” PCCP Inlay over milled HMA
Built: July 2007

Bremen Highway

Alternate Bid Results

Option	Low Bid
A. 4” HMA	$217,664.00
B. 6” PCCP	$309,822.75
C. 4” PCCP	$244,300.25

Bremen Highway

Mill 4” out & sweep surface

Fill with 4” PCCP

24’ Wide, single pass

0.8 mile long

Bremen Highway

Standard Finishing
& Texturing

Saw Cut 4’x4’ Panels

Bremen Highway

Excellent Results

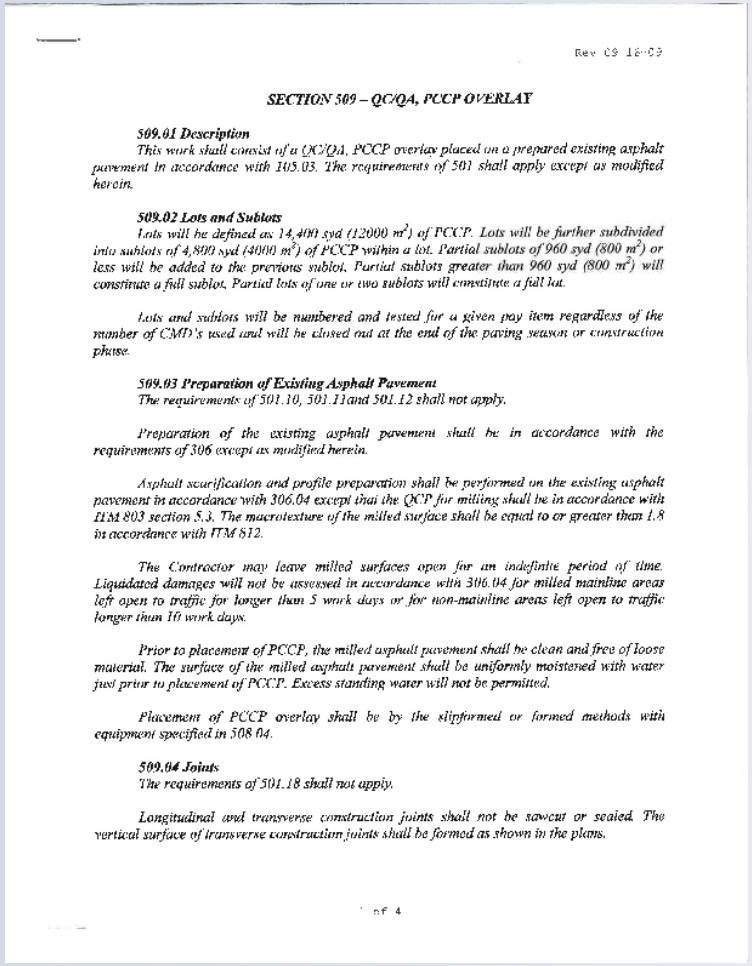
SR 161
(INDOT RS-30682-A)

6” PCCP Overlay

3.77 Miles long

71,000 SY

INDOT Specification 509



Rev 09 16-09

SECTION 509 – QC/QA, PCCP OVERLAY

509.01 Description

This work shall consist of a QC/QA, PCCP overlay placed on a prepared existing asphalt pavement in accordance with 105.03. The requirements of 501 shall apply except as modified herein.

509.02 Lots and Sublots

Lots will be defined as 14,400 syd (12000 m^2) of PCCP. Lots will be further subdivided into sublots of 4,800 syd (4000 m^2) of PCCP within a lot. Partial sublots of 960 syd (800 m^2) or less will be added to the previous sublot. Partial sublots greater than 960 syd (800 m^2) will constitute a full sublot. Partial lots of one or two sublots will constitute a full lot.

Lots and sublots will be numbered and tested for a given pay item regardless of the number of CMD's used and will be closed out at the end of the paving season or construction phase.

509.03 Preparation of Existing Asphalt Pavement

The requirements of 501.10, 501.11 and 501.12 shall not apply.

Preparation of the existing asphalt pavement shall be in accordance with the requirements of 306 except as modified herein.

Asphalt scarification and profile preparation shall be performed on the existing asphalt pavement in accordance with 306.04 except that the QCP for milling shall be in accordance with ITM 803 section 5.3. The macrotexture of the milled surface shall be equal to or greater than 1.8 in accordance with ITM 812.

The Contractor may leave milled surfaces open for an indefinite period of time. Liquidated damages will not be assessed in accordance with 306.04 for milled mainline areas left open to traffic for longer than 5 work days or for non-mainline areas left open to traffic longer than 10 work days.

Prior to placement of PCCP, the milled asphalt pavement shall be clean and free of loose material. The surface of the milled asphalt pavement shall be uniformly moistened with water just prior to placement of PCCP. Excess standing water will not be permitted.

Placement of PCCP overlay shall be by the slipformed or formed methods with equipment specified in 508.04.

509.04 Joints

The requirements of 501.18 shall not apply.

Longitudinal and transverse construction joints shall not be sawcut or sealed. The vertical surface of transverse construction joints shall be formed as shown in the plans.

of 4

SR 161, Dubois County

What Have Learned - Contractor

- Don’t be afraid of different practice
- Don’t make too complicated
- Basic straight forward construction practices
- Traffic control plan on project was very manageable – non-issue
- Profitable – good work

What Have Learned

- Don’t over engineer
- Cost competitive
- Don’t need dowels
- Don’t need tie bars
- Keep panels sized properly
- Joints – single cut - unsealed

Keep it simple

SR 161

Scarify/profile mill

Pave one lane at time

SR 161

Maintain local traffic
one way

SR 161

Bid Tab: $14.00/SY

$2.33/sy/in

($42.36/Ton Equivalent)

Urban Arterial –Allisonville Road - 1999

96th Street to Eller Road

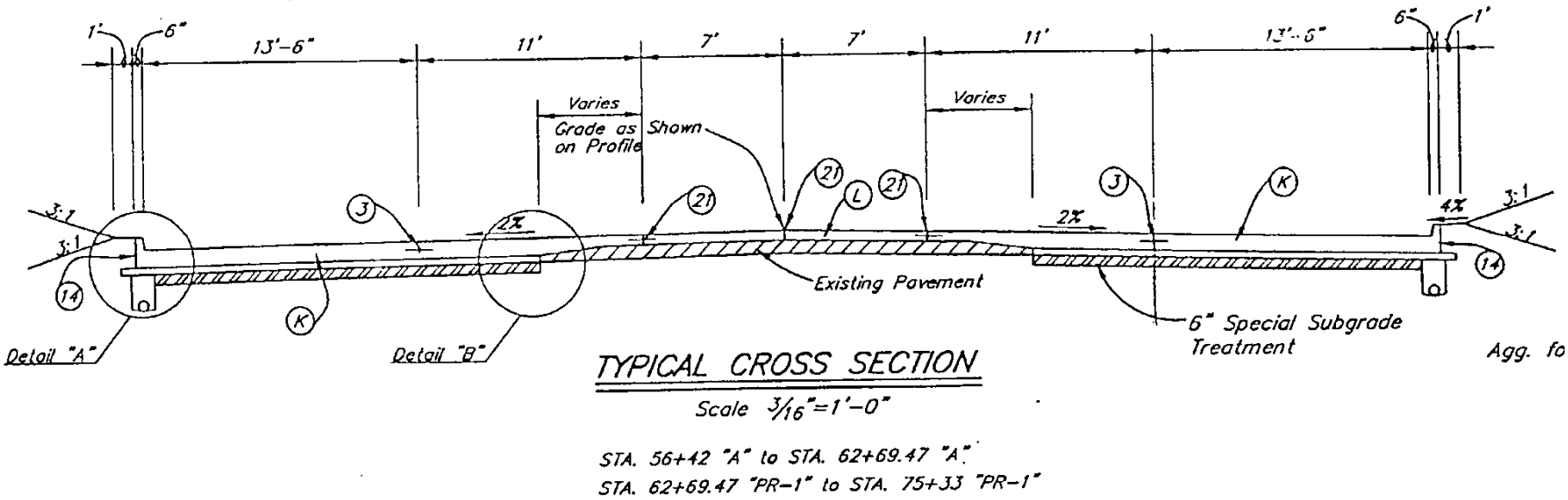
Project Information

- Traffic: 26,360 vpd
- Existing 24’ asphalt pavement
- Scope:
  - widen to outside
  - maintain traffic
  - mill & overlay existing

Pavement Design

- PCCP
  - plain, non-doweled with skewed joints
  - overlay: 7 1/2 “ PCC
  - widening: 10 1/2” PCC on 4” #53 aggregate base
  - Lime treated subgrade
- HMA
  - overlay: 5” HMA
  - widening: 15” HMA
  - Lime treated subgrade

Allisonville Road Cross Section



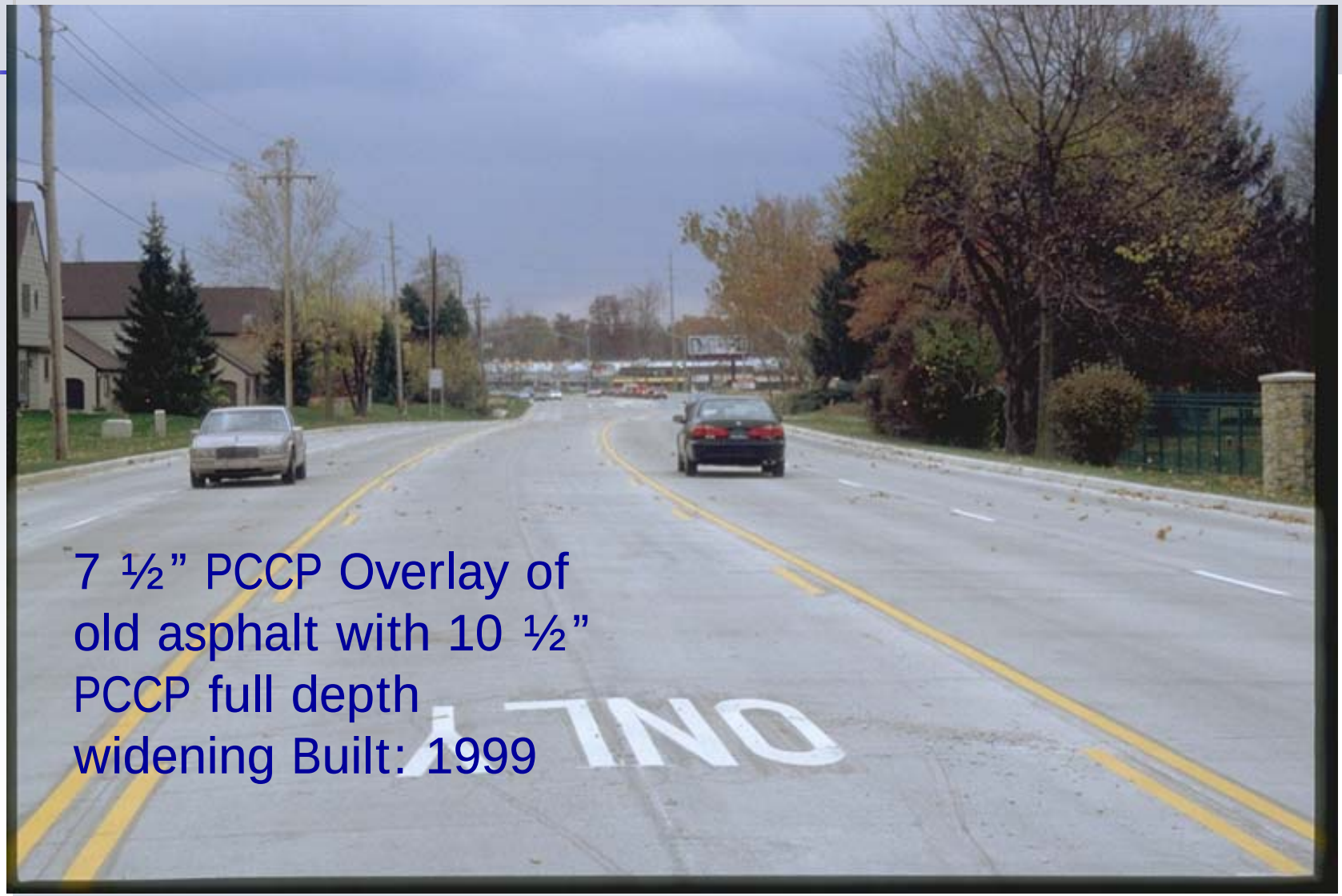
TYPICAL CROSS SECTION

Scale 3/16"=1'-0"

STA. 56+42 "A" to STA. 62+69.47 "A"

STA. 62+69.47 "PR-1" to STA. 75+33 "PR-1"

Allisonville Road



Airports – Delphi Runway 18-36

5” PCC Overlay of old HMA

2600’ – 60’ wide

Delphi Municipal Airport

Design – Concrete Overlay

- 5” Plain Concrete Pavement placed over existing asphalt runway
- Transverse joints spaced @ 12’-0”
- Longitudinal joints spaced @ 10’-0”
- All joints – sawed, beveled and sealed
- Outside longitudinal joint and the 3 transverse joints at north and south ends of runway – tied with ½” deformed bars spaced 3’- 0 c-c

As constructed – concrete overlay averaged 5.75”

BID TABULATION
DELPHI MUNICIPAL AIRPORT
RUNWAY "18-36" REHABILITATION
BASE BID

April 22, 2008

				Engineer's Estimate		Milestone Contractors, L.P. 3301 South CR 460 East Lafayette, IN 47905 Jeannie Ramsay (800) 377-7727	
ITEM	DESCRIPTION	QNTY	UNIT	Unit Price	Total Price	Unit Price	Total Price
	Base Bid Items						
1	M-102 Maintenance of Traffic	1	LS	$15,000.00	$15,000.00	$4,000.00	$4,000.00
2	M-103 Construction Engineering	1	LS	20,000.00	20,000.00	30,000.00	30,000.00
3	M-105 Mobilization/Demobilization	1	LS	100,000.00	100,000.00	278,263.00	278,263.00
4	P-101 Overlay Fabric for Bituminous Pavement (Undistributed)	300	SYD	15.00	4,500.00	12.00	3,600.00
5	P-101 Geocomposite Stress Relief Fabric for Bituminous Pavement (	100	SYD	65.00	6,500.00	62.00	6,200.00
6	P-401 Bituminous Surface Course	2,500	TON	80.00	200,000.00	60.00	150,000.00
7	P-401 Bituminous Base Course	3,200	TON	75.00	240,000.00	59.00	188,800.00
8	P-403 Bituminous Wedge and Level Course	56	TON	100.00	5,600.00	130.00	7,280.00
9	P-152 Unclassified Excavation	1	LS	30,000.00	30,000.00	40,000.00	40,000.00
10	T-902 Mulched Seeding	175	KSF	100.00	17,500.00	72.00	12,600.00
11	T-902 Mulched Seeding Warranty Bond	1	LS	1.00	1.00	250.00	250.00
12	P-611 Pavement Milling	1,700	SYD	4.00	6,800.00	6.00	10,200.00
13	P-620 Initial Pavement Markings (50% Application Rate) - White	5,627	SFT	3.00	16,881.00	0.75	4,220.25
14	P-620 Initial Pavement Markings (50% Application Rate) - Yellow	564	SFT	3.00	1,692.00	0.75	423.00
15	P-620 Final Pavement Markings (100% Application Rate) - White	5,627	SFT	3.00	16,881.00	0.60	3,376.20
16	P-620 Final Pavement Markings (100% Application Rate) - Yellow	564	SFT	3.00	1,692.00	0.60	338.40
17	P-620 Final Pavement Marking (100% Application Rate) - Black	311	SFT	3.00	933.00	1.00	311.00
18	SP-27 Full Depth Reclamation	17,682	SYD	5.00	88,410.00	4.00	70,728.00
19	SP-27 Portland Cement	565	TON	110.00	62,150.00	125.00	70,625.00
20	SP-28 Bituminous Pavement Joint	840	LFT	5.00	4,200.00	5.00	4,200.00
21	SP-29 Adjust Existing Light to Grade, Stake Mounted	21	EA	250.00	5,250.00	185.00	3,885.00
22	SP-29 Adjust Existing Light to Grade, Base Mounted	1	EA	500.00	500.00	1,200.00	1,200.00
23	SP-30 Haul Road Repair (Undistributed)	175	TON	150.00	26,250.00	100.00	17,500.00
24	SP-35 Existing Runway Lighting Repair (Undistributed Allowance)	1	T & M	5,000.00	5,000.00	5,000.00	5,000.00
	ALTERNATE BID NO. 1						
1	P-403 Bituminous Surface Course	2,500	TON	70.00	175,000.00	53.00	132,500.00
2	P-403 Bituminous Base Course	3,200	TON	65.00	208,000.00	57.00	182,400.00
				Base Bid Total	$875,740.00		$912,999.85
				UBE	$900,000.00		

Project Bid Tabs – Base: FDR w/ HMA Overaly

$912,999.85

BID TABULATION
DELPHI MUNICIPAL AIRPORT
RUNWAY "18-36" REHABILITATION
ALTERNATE NO. 3

April 22, 2008

				Engineer's Estimate		E&B Paving 310 Blacketor Dr. Rochester, IN 46975 John Bowers (574) 223-4644	
ITEM	DESCRIPTION	QNTY	UNIT	Unit Price	Total Price	Unit Price	Total Price
	ALTERNATE BID NO. 3						
1	M-102 Maintenance of Traffic	1	LS	15,000.00	15,000.00	$9,756.74	9,756.74
2	M-103 Construction Engineering	1	LS	20,000.00	20,000.00	24,173.63	24,173.63
3	M-105 Mobilization/Demobilization	1	LS	30,000.00	30,000.00	34,735.15	34,735.15
4	P-101 Overlay Fabric for Bituminous Pavement (Undistributed)	300	SYD	15.00	4,500.00	19.32	5,796.00
5	P-101 Geocomposite Stress Relief Fabric for Bituminous Pavement (	100	SYD	65.00	6,500.00	57.41	5,741.00
6	P-501 5" Portland Concrete Pavement	17,682	SYD	30.00	530,460.00	28.15	497,748.30
7	P-401 Bituminous Surface Course	375	TON	80.00	30,000.00	70.00	26,250.00
8	P-403 Bituminous Wedge and Level Course	56	TON	100.00	5,600.00	130.00	7,280.00
9	P-152 Unclassified Excavation	1	LS	30,000.00	30,000.00	20,838.30	20,838.30
10	T-902 Mulched Seeding	175	KSF	150.00	26,250.00	72.17	12,629.75
11	T-902 Mulched Seeding Warranty Bond	1	LS	1.00	1.00	255.00	255.00
12	P-611 Pavement Milling (2" Avg. Depth)	1,700	SYD	3.00	5,100.00	5.15	8,755.00
13	P-611 Pavement Milling (1/8" to 1/2" Depth)	17,682	SYD	1.50	26,523.00	1.07	18,919.74
14	P-620 Initial Pavement Markings (50% Application Rate) - White	5,627	SFT	3.00	16,881.00	0.77	4,332.79
15	P-620 Initial Pavement Markings (50% Application Rate) - Yellow	564	SFT	3.00	1,692.00	0.77	434.28
16	P-620 Final Pavement Markings (100% Application Rate) - White	5,627	SFT	3.00	16,881.00	0.97	5,458.19
17	P-620 Final Pavement Markings (100% Application Rate) - Yellow	564	SFT	3.00	1,692.00	0.97	547.08
18	P-620 Final Pavement Marking (100% Application Rate) - Black	2,992	SFT	3.00	8,976.00	0.87	2,603.04
19	SP-29 Adjust Existing Light to Grade, Stake Mounted	21	EA	250.00	5,250.00	185.79	3,901.59
20	SP-29 Adjust Existing Light to Grade, Base Mounted	1	EA	500.00	500.00	1,198.50	1,198.50
21	SP-30 Haul Road Repair (Undistributed)	175	TON	150.00	26,250.00	91.80	16,065.00
22	SP-32 INDOT No. 53 Crushed Aggregate, 4" Thick	65	CYD	35.00	2,275.00	54.10	3,516.50
23	SP-35 Existing Runway Lighting Repair (Undistributed Allowance)	1	T & M	5,000.00	5,000.00	5,000.00	5,000.00
				Base Bid Total	$815,331.00		$715,935.58
				UBE	$860,000.00		

Project Bid Tabs – Alternate: Concrete Overlay

$715,935.58

Surface Preparation

Placement


GOMACO
GHP2800
432053

Finishing

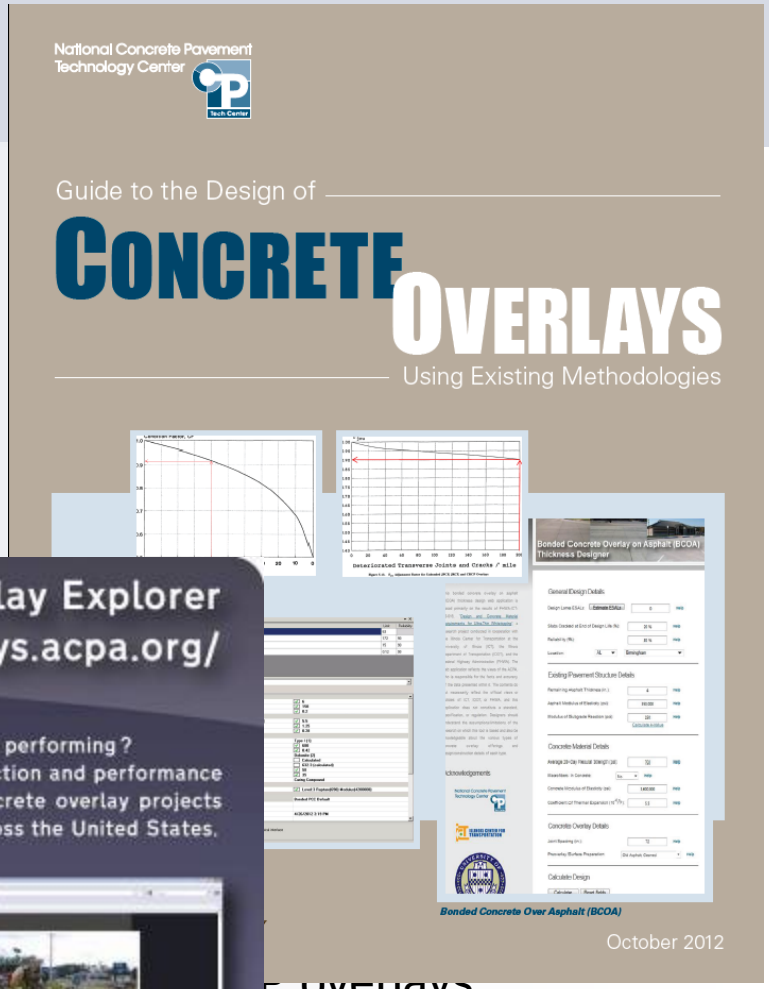
Curing


0.48

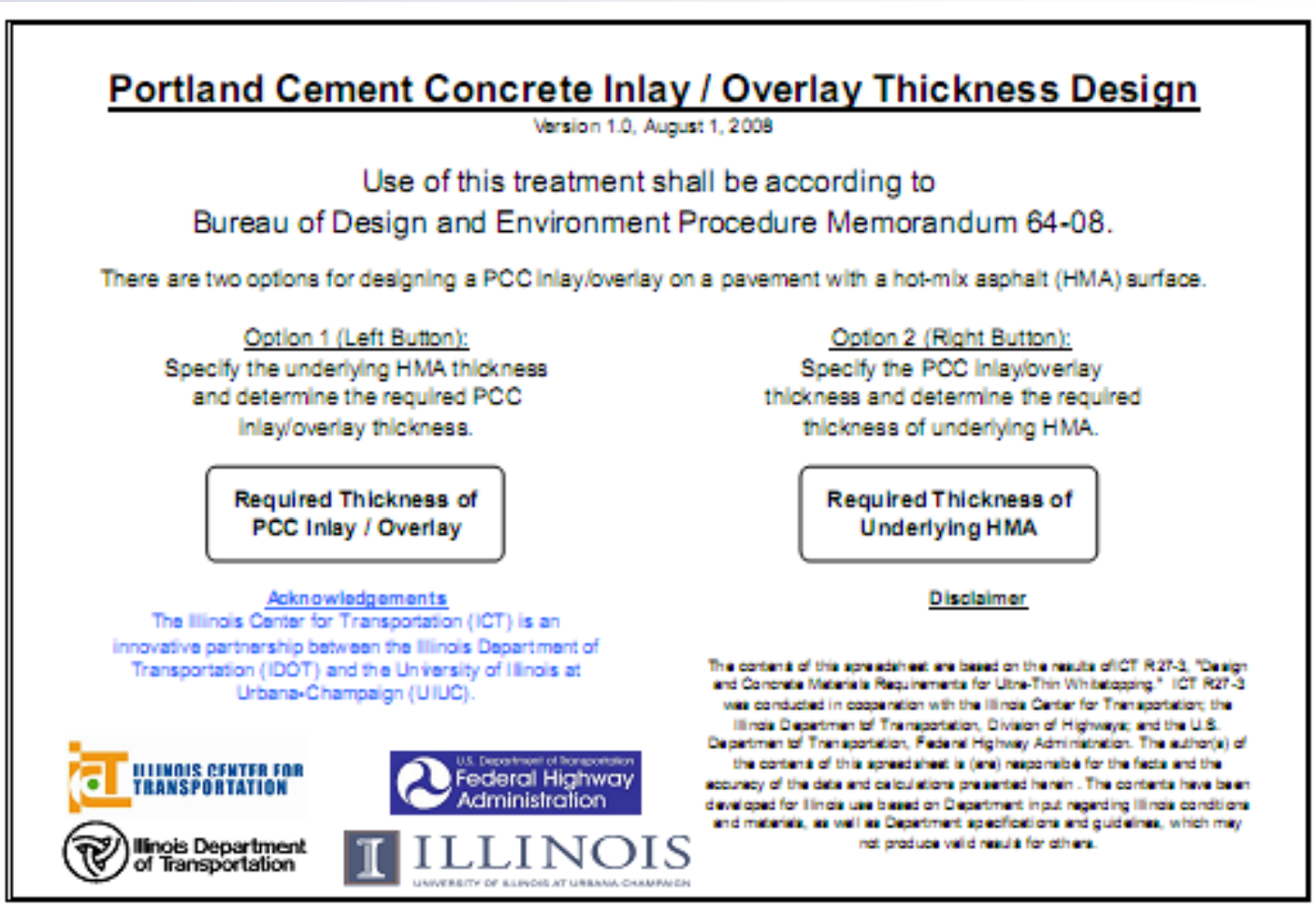
Sawing

Notice crack & broom finish

Concrete Overlays - Resources



DESIGN SPREADSHEET



Portland Cement Concrete Inlay / Overlay Thickness Design

Version 1.0, August 1, 2008

Use of this treatment shall be according to
Bureau of Design and Environment Procedure Memorandum 64-08.

There are two options for designing a PCC inlay/overlay on a pavement with a hot-mix asphalt (HMA) surface.

Option 1 (Left Button):
Specify the underlying HMA thickness and determine the required PCC inlay/overlay thickness.

Required Thickness of PCC Inlay / Overlay

Option 2 (Right Button):
Specify the PCC inlay/overlay thickness and determine the required thickness of underlying HMA.

Required Thickness of Underlying HMA

Acknowledgements

The Illinois Center for Transportation (ICT) is an innovative partnership between the Illinois Department of Transportation (IDOT) and the University of Illinois at Urbana-Champaign (UIUC).

Disclaimer

The contents of this spreadsheet are based on the results of ICT R27-3, "Design and Concrete Materials Requirements for Ultra-Thin Whitetopping." ICT R27-3 was conducted in cooperation with the Illinois Center for Transportation; the Illinois Department of Transportation, Division of Highways; and the U.S. Department of Transportation, Federal Highway Administration. The author(s) of the contents of this spreadsheet is (are) responsible for the facts and the accuracy of the data and calculations presented herein. The contents have been developed for Illinois use based on Department input regarding Illinois conditions and materials, as well as Department specifications and guidelines, which may not produce valid results for others.

ILLINOIS CENTER FOR TRANSPORTATION

U.S. Department of Transportation Federal Highway Administration

Illinois Department of Transportation

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

What Have We Learned

- Cost Competitive
- Long Lasting
- Versatile
- Traditional Construction
- Constructed Rapidly
- Design & Tech Guidance Tools Available
- Wide Spread Use Across Country

Questions?

Contacts for further information

www.irmca.com

www.indianaconcretepavement.com

INDIANA CHAPTER